Contents

Cha	apter One · Coordinate Geometry of the Plane			
1	Line Segments in the Plane, 1			
2	Exercises 1, 8 Position-Ratio of a Point on a Line, 8			
	Exercises 2, 10			
3	Angle between Two Lines, 11			
	Exercises 3, 13			
4	The Direction-Ratios of a Line, 13			
	Exercises 4, 16			
5	The Intersection of Two Lines, 16			
	Exercises 5, 19			
Chapter Two · Vectors in Two Dimensions 21				
6	Directed Line Segments and Vectors, 21			
	Exercises 6, 25			
7	Linear Dependence of Vectors, 25			
	Exercises 7.1, 27			
	Exercises 7.2, 29			
	Exercises 7.3, 32			
8	The Inner Product of Two Vectors, 32			
	Exercises 8.1, 35			
	Exercises 8.2, 37			
Ch	apter Three · Coordinate Geometry of Three Dimensions 38			
9	The Axes, and Lines through the Origin, 38			
	Exercises 9, 41			
10	Angle between Two Lines, 42			
	Exercises 10, 44			
11	Line Segments in Space, 44			
	Exercises 11, 50			

12 Position-Ratio of a Point on a Line, 51

Exercises 12, 52

×	CONTENTS	
13	The Equation of a Plane, 52	
	Exercises 13, 56	
14	Planes and Lines, 56	
	Exercises 14, 60	
15	The Intersection of Two Planes,	61

Exercises 15, 63

Chapter Four · Vectors in Three Dimensions 64

16	Vectors and Linear Dependence,		64
	Exercises 16.1,	66	
	F	70	

Exercises 16.2, 70
17 Determinants of Orders 2 and 3, 70
Exercises 17.1, 72
Exercises 17.2, 76

Exercises 17.3, 82

18 Vanishing Determinants, 83 Exercises 18, 85

19 The Inner Product of Two Vectors, 86 Exercises 19, 89

Chapter Five · Linear Equations with a Unique Solution 91

- 20 Regular Systems of Linear Equations, 91 Exercise 20, 97
- 21 Regular Systems, the General Case, 98 Exercises 21, 105
- Deductions from the Theorems on Regular Systems, 105Exercises 22, 110
- 23 The Notion of a Basis, 110

Chapter Six · Vector Spaces 114

24 Vectors and Vector Spaces, 114

Exercises 24.1, 117

Exercises 24.2, 118

25 Linear Dependence and Generators, 118 Exercises 25, 123

26 The Echelon Form, 123 Exercises 26, 128

27 Intersections and Joins of Subspaces, 131
 Exercises 27.1, 133
 Exercises 27.2, 136
 Exercises 27.3, 139

Chapter Seven · Matrices 148

29 Definitions, 148

Exercises 29.1, 153

Exercises 29.2, 157

Exercises 29.3, 159

30 Regularity and Inverse Matrices, 160 Exercises 30.1, 167

Exercises 30.1, 16/ Exercises 30.2, 168

Chapter Eight · The Concept of Rank 169

31 The Rank of a Matrix, 169

Exercises 31.1, 172

Exercises 31.2, 180

Exercises 31.3, 182

32 Properties Involving the Rank of a Matrix, 182

Exercise 32.1, 183

Exercise 32.2, 184

Exercises 32.3, 184

Exercise 32.4, 188

33 Homogeneous Linear Equations, 190

Exercise 33, 192
34 Non-homogeneous Linear Equations, 192

Exercise 34.1, 193

Exercise 34.2, 194
35 Determinants of Order n, 194
Exercises 35. 200

Chapter Nine · Linear Mappings and Matrices 201

36 Linear Mappings, 201 Exercises 36.1, 205

Exercises 36.2, 207

37 Linear Mappings and Matrices, 210 Exercises 37, 212

Answers to Exercises 217

Index 221